SCIENCE.

FRIDAY, SEPTEMBER 4, 1885.

THE FUTURE OF THE LICK OBSERVATORY.

The history and description of this observatory, and the astronomical work already accomplished on Mount Hamilton, which we have given on a later page, lead very naturally to a statement of the chief advantages which, in so far as the observatory and its position and equipment are concerned, may reasonably be expected to accrue from this new departure in astronomical science.

The fact of mere elevation (less than a mile) above the sea-level will not, as is often supposed, greatly increase the apparent light of celestial objects, as the stars will appear to be only a small fraction of a magnitude brighter on the mountain than at the sea-level. But — what is incomparably more important — the gain in steadiness of the atmosphere at this elevated station has already been proven to be much greater than any one expected at the outset, and will enable the astronomer not only to make good use of a multitude of clear nights which, at less elevated stations, are found to be of little value, but also to elevate the grade of all his work to the last degree of precision. The perfection of this site for observations with the meridian circle — in fact, for all micrometric observation of whatever sort — will force the invention of better methods of eliminating personal and instrumental errors than we now possess. So far as the conditions of vision affect the stars' diurnal motion, the errors introduced in stellar co-ordinates will be so small that two or three observations of a star will suffice for the most accurate determination of its position. An enormous saving in the labor of observation and reduction is thus possible, if only the other errors can be eliminated with certainty from so small a number of observations. With regard to the influence of elevation upon the conditions of day-vision, it should be noted here that the testimony of Mr. Burnham in 1879, of Professor Holden in 1881, and of Professor Todd in 1882, is uniformly to the effect that the atmosphere above Mount Hamilton is quite as unsteady during the daytime as at other stations. This remark, however, must be understood as applying only to the period of the year from the middle of August to the middle of December, as no accurate observations upon this matter have been made in other months. It is very possible that the conditions of the atmosphere in late spring and early summer may give an entirely different experience at these seasons.

The elevation above a mile of the lower atmosphere becomes significant in another way, however, as it makes effectively available a much larger region of sky than can be commanded at other stations in a like latitude, where observations at zenith distances much greater than seventy degrees are usually not worth the making. Mr. Burnham directs attention to this fact, as affecting observations in that portion of the southern celestial hemisphere which is ordinarily inaccessible for observations of precision at our northern observatories. At the latitude of Mount Hamilton, the fifty-third parallel of south declination is about co-incident with the south horizon; and, out of forty-two new double-stars discovered by Mr. Burnham during his residence upon the mountain in 1879, twenty are between the thirtieth and fortieth parallels of south declination (that is, between limits of maximum altitude equal to twenty-three and thirteen degrees); and five of the new stars are between the fortieth and forty-fourth parallels, or between limits of maximum altitude equal to thirteen and nine degrees only. This important advantage will not be confined to the southern horizon only, but will duly influence all fields of astronomical inquiry where important observations have occasionally to be taken near other parts of the horizon.

The prevalence of violent winds on the summit, and particularly their effect upon the steadiness of the atmosphere, have not yet been thoroughly investigated. As a general rule, astronomers at ordinary elevations expect to find severe winds accompanied by atmospheric conditions which do not admit of satisfactory micrometric work. Mr. Burnham found that moderately strong winds did not seem to affect the optical steadiness of the atmosphere. A remarkable experience of my own on the mountain may be mentioned here. On the night of the 2d of December, 1882, when the wind was blowing steadily with such violence as to make it extremely hazardous to open the dome in the face of it, I found Jupiter and Saturn very unsteady and much

blurred; but turning to Sirius, I found the companion an extremely conspicuous object, — in fact, the note in my observing-book is to the effect that the companion was "as readily seen as a satellite of Jupiter." So far as I am aware, this is a unique experience of the effect of severe wind upon the optical quality of the atmosphere.

The location of the observatory in a region which is entirely cloudless during the greater part of the year, constitutes an advantage which only those can fully appreciate whose work has suffered serious interruption from the lack of a continuously clear sky. Should those permanently in charge of the observatory find it desirable to continue observations throughout the period of five months known as the 'rainy season,' it would doubtless be found that the superior elevation would afford a clear sky throughout one-third to one-half of this period, and simultaneously with clouds and storms at stations lower down. During my own residence on the mountain in the latter part of 1882, and shortly after the beginning of the rainy season, this was frequently the case; and on two separate occasions we were favored with an uninterruptedly clear sky for more than seventy consecutive hours, being situate on an island in a sea of cloud which obscured every thing beneath the immediate summit. A series of excellent photographs of this cloud-sea was obtained, one of which is well reproduced in the illustration on p. 191. Ocean fogs rarely reach the elevation of the observatory. Mr. Burnham observed these fogs drifting in from the Pacific nearly every night at about the time of sunset. Their usual altitude was about two thousand feet, and they did not appear to affect the seeing.

The instrumental equipment of the observatory, although incomplete, is already an unusual one, and, in its final state, will surpass that of all other observatories. The instruments have been designed, constructed, and mounted in the most thorough manner; and particular care has been taken that all the movable portions of the buildings covering these instruments (always a source of unending trouble and vexatious delay to the astronomer) shall be so arranged and constructed as to cause a minimum of annoyance and interruption.

The great advantages arising from the observers' ability to reside near their instruments must not be overlooked here. A suitable dwelling-house for the observers has been provided in the immediate proximity of the instruments, so that all the time available for observatory work may be fully utilized.

The means of publication — a most important consideration in the management of a great observatory — has not escaped due notice. The legislature of California has already shown its entire appreciation of the observatory and its work, by the passage, at its last session, of a joint resolution providing for the issue of such reports, observations, and researches, as may, with the approval of the governor of the state, be submitted by the Lick trustees, or the regents of the university, for publication.

Finally, and most important of all, there is an assured endowment of generous proportions, the income from which is wholly available for the maintenance of the establishment, and the prosecution of its work. The considerate management of the trustees will enable them to complete the observatory at a cost not much exceeding three-fifths of the entire allotment of Mr. Lick's bequest for this purpose, and the remainder will constitute the permanent endowment-fund of the institution.

Fortune and necessity, however, do not fail to accompany this unique combination of opportunities with more or less of disadvantage. The unavoidable obstacles of the undertaking have been great, but they have also been surmounted. But the necessary expense of maintaining so large an establishment at so elevated a station, the cost of living, the social isolation of the astronomers, amounting to practical exile for months at a time when series of observations requiring uninterrupted attention are in hand, — these, and other obvious considerations, must be carefully considered by any one who attempts a fair estimate of the work which the Lick observatory is destined to accomplish. While it appears that the institution will be in a strong position to conduct and maintain a good degree of astronomical research with its own resources, there will be abundant field for prudent financiering in the management of its practical affairs. However, when the trustees are ready to resign the control of the observatory, the character of its instrumental and other equipment will be such that all increase of its permanent income, derivable from outside sources, will be wholly available for the pursuit of new and interesting lines of research. The nature of investigations of this sort enables the astronomer to make successful appeal for the funds necessary to carry them on; and the trustees have wisely refrained from equipping the observatory with any instruments and apparatus which will

not be of immediate necessity in the conservative lines of astronomical inquiry.

DAVID P. TODD.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

A method for determining the unit of light.

IN all photometric work hitherto undertaken, one of the main difficulties has been to obtain a satisfactory standard of light, — one which will be always constant, and which can be accurately duplicated. Heretofore, all experiments in this direction have been failures. The plan here suggested contemplates, not the employment of a unit quantity of light, but the employment of a certain effect produced by that unit quantity as a standard. In other words, it makes not the light, but the photometer, the constant.

This photometer must, then, be some device for measuring radiant energy. But, for photometric purposes, we wish only to measure that portion of the energy which has a wave-length readily visible to the human eye. With the great differences in color of our modern sources of illumination, it is absolutely impossible to state an exact equivalence between the yellow light of a candle-flame, and the blue light of an electric arc. For really accurate work, we can compare only light rays of the same wave-length. As the human eye is most sensitive to light from that portion of the spectrum between the *D* and *E* lines, in the following plan I have selected that region of the spectrum to be used exclusively for the comparison of the brilliancy of the various lights. In all probability, the total brilliancy of an incandescent body does not increase in a ratio exactly proportional to the increase in brilliancy of the yellow rays; but this difference, within practicable limits, is probably so small as to be entirely negligable. And we have the advantage of being able to state an accurate arithmetical ratio between the lights, instead of what must be at best a mere general comparison of the relative effect of the two lights upon our eyes.

Briefly stated, then, the method I would suggest consists in moving the light to be measured towards the slit of a spectroscope, until a certain effect is produced upon a screen so placed as to receive the yellow rays. When this effect is produced, the spectroscope is receiving the standard amount of light from the source; and the brilliancy of the source can then be determined by measuring its distance from the slit.

In attempting to apply this method, the difficulty which at first arises is, to obtain an effect which can be measured with accuracy. By permitting the spectrum of a light to fall upon suitable screens, three classes of effects may be obtained; namely, heating, visual, and chemical. Of these, the second is evidently unsuited for the purpose of obtaining a standard. The third is too uncertain, and not susceptible of sufficient accuracy, so that the first alone remains. Of the two practicable heat methods of measuring radiant energy, the thermopile is the more sensitive; but the bolometer responds the quicker to changes of temperature, and has the narrower surface. The latter instrument has, therefore, been selected for this application of the method. The unexposed arm of the bolometer has a slight additional adjustable resistance thrown into its circuit, so that, when the instrument is not in use, the needle of the galvonometer will have a certain deflection dependent on the strength of the battery-current employed. When the light to be measured is placed in front of the slit of the spectroscope (which should be quite broad), the deflection will be diminished. As the light approaches the slit, the deflection will decrease, and finally become zero, at which time it is giving out the standard light. Its brilliancy can now be read off from its position upon a scale placed in front of the slit and parallel to the collimator.

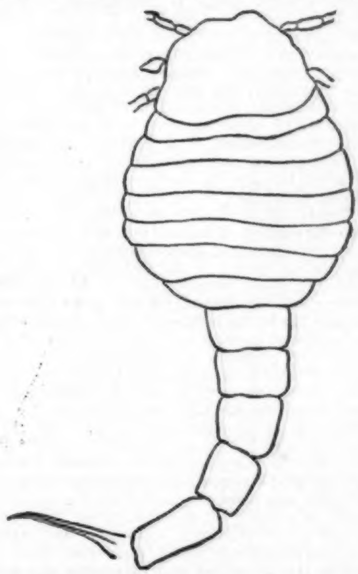
This photometer might also be used to adjust the position at which an incandescent electric or other lamp should be placed in order to furnish a constant supply of light. This source could then be used as a unit in an ordinary photometer.

WM. H. PICKERING.

An American Silurian scorpion.

The 'American scorpion' from the water-lime group of New-York State, described by Professor Whitfield on pp. 87, 88, is undoubtedly a young specimen of Eusarcus scorpionis (Grote and Pitt: Bulletin of the Buffalo society of natural sciences, vol. iii., pp. 1, 2), so named by an error, and which will be redescribed as Eurypterus scorpionis in the forthcoming vol. v. of the society's bulletin.

The enclosed is a sketch of the youngest specimen in my possession, drawn full size: the largest I have,



indicates an animal at least three feet long. There cannot be any doubt as to its zoölogical position; for the characteristics of the genus Eurypterus — eyes placed within the margin of the carapace, and a triangular spine as caudal appendage — can be distinctly identified.

All my specimens have been found in the water-lime group at Buffalo, associated with Eurypterus, Pterygotus, and Ceratiocaris. JULIUS POHLMAN.

Buffalo, N.Y., Aug. 5.

OF course it would be rather hazardous for me to say that the American scorpion, described in a former number of *Science*, was not the young of Eusarcus scorpionis (Grote and Pitt), in as positive language as Mr. Julius Pohlman says it is; for our knowledge of the embryonic features and development of the Eurypteridae is yet too little to allow of many positive assertions, where not accompanied by absolute evidence. Still I must say that I do not believe it to be the young of that or any other Eurypterid. The form of the limbs, the existence of the nipper-shaped palpus and of an apparently true mandible, resembling so much those of the Scorpionidae, are features which we should scarcely look for in an embryonic or undeveloped form of Eurypterus. If Mr. J. Pohlman had seen the photographs of the specimen instead of the rude cut, or had examined the specimen itself, I think he would have expressed a very different opinion. R. P. WHITFIELD.

The geology of natural gas.

I do not wish to enter into a further discussion of the interesting question of the geology of natural gas, in anticipation of the results of a special investigation which has just been commenced in the oil and gas regions by Mr. John F. Carll for the State geological survey, but, in reply to Prof. I. C. White's criticism of my letter on this subject, I desire to state a few facts in support of my conclusion, that the 'anticlinal theory' alone is insufficient to account for the existence of natural gas, in all localities in the Pennsylvania and adjoining gas regions. In order to clearly understand this communication, reference should be made to *Science*, June 26 and July 17.

In the first place, it is important to know that the general statements contained both here and in my letter of July 17, refer, not only to all the gas regions of Pennsylvania which, with possibly the exception of the Erie district, are geologically connected with the oil-fields, but also to those other gas localities in New York, Ohio, and West Virginia which are not in the vicinity of producing oil-wells. The facts relating to the geology of natural gas, now in the possession of any one geologist, are not sufficiently numerous or connected to permit of the deduction of any ultimate theory; and it is only possible, for the present, to deduce special geotectonic conditions under which natural gas has so far been exploited. Some of these conditions are so varying and apparently antagonistic, that it is only possible to differentiate any one of the general laws controlling the occurrence of natural gas by a comparison of the individual facts obtained from innumerable well-drillings.

The facts given here will serve to elucidate my previous article, and I hope will prove to be sufficient to clearly define the few conclusions at which I have arrived, from field observations extending over a period of ten years, and from numerous studies in conjunction with Mr. Carll, of the results of his surveys, which are more thorough, complete, and valuable than any examinations which have ever been made bearing on the geology of both petroleum and natural gas.

The general structure of the strata drilled through by the gas-wells in the vicinity of Pittsburgh) now considered the most important gas district) is the same as that of the strata in the different parts of the Devonian and carboniferous series pierced by the oil-wells at the Smith's Ferry (30 miles N. 60° W. from Pittsburg) and the Slippery Rock (34 miles N. 20° W. from Pittsburgh) districts, where in both districts heavy oil is obtained from the base of the coal measures, and amber oil from the Berea grit; in the Thorn Creek (25 miles N. 5° E. from Pittsburgh), and south end of the Clarion, Butler, and Armstrong (28 miles N. 20° E. from Pittsburgh) districts, where oil is obtained from the Venango (Devonian) sands; and in the Pleasant Unity (30 miles S. 65° E. from Pittsburgh), Dunlap Creek (31 miles S. 12° E. from Pittsburgh), Whiteley Creek (45 miles S. from Pittsburgh), and Dunkard Creek (48 miles S. from Pittsburgh) districts, where oil is obtained from the Mahoning sandstone (lower barren coal measures) and overlying strata. The discovery of oil at Mount Nebo, about eight miles north-west of Pittsburgh, and the several small oil-wells reported to have been obtained in close proximity to the Washington (Chartiers Creek) gas-wells, together with traces of oil found upon special examination in the gas from wells which are supposed to produce absolutely dry gas (the gas obtained from the Carpenter well on the Daum farm, Westmoreland county, was supposed to be free from oil or water: when, however, the gas was confined under a pressure of a hundred and sixty pounds to the square inch, water was precipitated), the existence of natural gas, either in or near *all* the productive oil-pools, under geological and physical conditions similar to those found to obtain in what are frequently spoken of as 'natural-gas regions proper,' are all sufficient reasons for considering the districts producing either oil or gas exclusively (?) one in a geological sense.

Gas-wells are not entirely confined to narrow belts (one-fourth to one mile wide) along the crests of anticlinal folds, nor are those which have apparently been found in synclines necessarily in the vicinity of subordinate crumples or anticlinal rolls which are so frequently found in extensive basins. The "dip of the gas-sand and the position of the anticlines and synclines" is the third of the five principal geological and physical conditions, which I have already enumerated (*Science*, July 17), which seem to influence the occurrence of natural gas, and in special cases would seem to be the most important consideration. Most of the saddles and basins in western Pennsylvania have a progressive dip along their axial line toward the south-west; and a well, drilled half a mile to the north-west or south-east of a given point on the crest of an anticline, will encounter any given stratum at the same elevation as a well drilled immediately on the crest of the same anticline at a distance south-west from the given point, the distance in each case being dependent upon the intensity of the dip in the three directions. The anticline along which the famous Murraysville gas-wells in Westmoreland county have been drilled is an instance.

About ten miles north-east of the village of Murraysville, two large gas-wells have been obtained about three miles apart (north-west and south-east), one on Beaver Run, the other on Pine Run. The total dip of the Upper Freeport coal-bed, from the Beaver-run well to the Pine-run well, is two hundred and fifteen feet, or at the rate of seventy feet per mile toward the north-west. The former well is found in close proximity to the anticlinal axis along which the great Murraysville wells are obtained, farther to the south-west; while the latter well is near the synclinal axis. The extension of the general direction of this anticlinal line to the north-east of the Beaver-run well crosses the Conemaugh River near the mouth of Roaring Run, where a well was drilled, evidently on account of the existence of the anticline at that point; but no gas was found. The Apollo well, about three miles north-east of the Pine-run well, along a line parallel to the structural lines of the district, found no gas. In the

case of the Roaring Run and Apollo wells, it may be possible that no porous stratum, which could serve as a gas reservoir, was pierced by the drill: this, as already stated (*Science*, July 17), is the first necessary condition of the existence of gas.

The Ridgway gas-well is located in a syncline, and not on a subordinate anticline, as has been suggested, but at a point where there is a certain regular dip of about 1° toward the west, on the side of the syncline. The Kane gas-wells — including the large one at Kane, which is now supplying the residents of the town with light and fuel, and the famous Kane geyser (gas) well — are both in a syncline, the south-east dip, in the one case, and the north-west dip, in the other case, toward the centre of the basin, being less than fifty feet per mile; and the south-west dip along the axis of the basin being from fifteen to twenty-five feet per mile. The great McMullen & Hallet gas-well, commonly known as the 'Mullen snorter,' is not in the vicinity of any anticline. The gas-sand at this well is nearly horizontal, having a dip of about eleven feet only in a direction S. 15° W.

The gas-wells found in the vicinity of the city of Erie are located in a region where no anticlines or synclines have been discovered. The dip of the rocks here is toward the south-west, at the rate of about twenty feet per mile, from recent surveys: or from the surveys made nearly fifty years ago, by the First geological survey, as pointed out by Professor Lesley, the average dip was estimated to be fourteen feet per mile. Gas-wells have been drilled in the vicinity of Fredonia, New York, one as early as 1821. Gas is still obtained here; and, as far as the structure has been made out, no anticlines exist in the vicinity of the Fredonia wells.

While these few facts would seem to be enough to show that all gas-wells, either in the vicinity of productive oil territory, or at considerable distances removed therefrom, are not necessarily in the vicinity of anticlines, many instances might be cited, particularly in the gas regions recently developed in Pennsylvania, to show that some of the largest and most productive wells are either on or in the vicinity of anticlinal crests. I am free to admit, as I have already done, that the position of anticlines and synclines have an important bearing upon the location of profitable gas-wells; but I cannot believe that, in view of our present knowledge, the 'anticlinal theory' is sufficient to account for all occurrences of natural gas. As to whether it will be possible for facts still to be recorded to give any geologist an adequate basis for the formulation of an ultimate theory, we must await the results of Mr. Carll's present investigation.

CHAS. A. ASHBURNER,
Geologist in charge Penn. surv.

907 Walnut Street, Philadelphia,
Aug. 24.

Annuaire géologique universel.

The undersigned being mentioned, under the name of Dr. *Svedonius*, amongst the collaborators in the above-named work recently published by Dr. Dagincourt in Paris, and two articles on Sweden and Norway appearing in the same, signed in my name, of which I had no knowledge *until after* their publication, I do hereby declare that the said articles are not composed by me, but are uncritically compiled from two pamphlets printed in the years 1874 and 1878, and are, consequently, now substantially antiquated pamphlets, with the authorship of which I had nothing whatever to do. These pamphlets, together with several others on the same subject, I have, at the request of a Swedish man of science, forwarded to Dr. Dagincourt, emphatically pointing out the time of their publication; and to this my collaboratorship in the annual is restricted.

DR. F. SVENONIUS,
State geologist.

Stockholm, July 31.

Probable period of gestation in the 'horned toad.'

On the 15th of May last I captured a very fine specimen of an adult female Phrynosoma Douglassii. The fact having long been known to me that these reptiles are capable of sustaining prolonged fasts without any apparent inconvenience, I determined to test the question for my own satisfaction and information. Accordingly, this specimen was placed where it was impossible for it to secure any food. One month after its incarceration it was taken out to be examined. No particular change was noticeable; the barest traces of emaciation could be seen in the limbs; but the creature upon being teased puffed itself up, as they do, and made short leaps with open mouth at my finger. It also ran nimbly about my study.

It was replaced in its limited quarters, and another month passed by without its having taken a particle of nutriment. Its eyes now had a slight sunken appearance, and some shrinkage of the limbs could be detected. I dipped it in water for a moment, and once more introduced it to its narrow prison. At this stage of the proceedings my chief surprise arose from the fact that the body of the animal still retained its rotund contour, and was, if any thing, plumper than at the time of the inauguration of the experiment.

Upon this date it had passed no excrementitious matter for nearly three weeks.

My surprise was great, when, in looking into the box on the afternoon of the 10th of the present month, to find strewed about the bottom of it no less than seven newly-born young. These were all dead, and enveloped in their membranes, which latter also enclosed a bright yellow yelk about as large as a small pea. At the time, circumstances prevented me from making any further examination; but, two hours later, my astonishment was at its pitch, when I found *fourteen* more young had come to light. Two of these were without the membranes and yelk, but every one of the twenty-one was dead.

Upon examining the mother, it was at once evident that her labor had not terminated; and, indeed, within the next ten minutes she was delivered of three more young ones. These were all born tail first: two of them were living, and had to be simply freed from their envelopes, the yelks having been absorbed. The remaining one was like the majority of the others, and lived but a moment or two.

As I write these lines I have before me twenty-two of the young in alcohol, two live and active little fellows of the same brood, and the mother-lizard, who, though she has lost much of her original activity and flesh during her *three months'* test, looks for all the world as fully capable of enduring many more days of it.

Taking all the circumstances I have related into consideration, I believe it will be found that about one hundred days is the period of gestation of this viviparous reptile.

It will be of interest to state, in the present connection, that other lizards endure these fasts as well as Phrynosoma; for I have a large Sceloporus, un-

dergoing the test, that has suffered but very little, not having partaken of any food whatever for over a month.

I had a live Sceloporus consobrinus about my room here nearly two months, but one day it was missed, and ten days afterwards it was found in a dark corner. Nothing remained of it but the skin, enclosing a perfect skeleton and seven eggs. These latter had firm white shells, and were each of an elliptical form.

R. W. SHUFELDT.

Fort Wingate, N. Mex., Aug. 12.

Color and other associations.

In the matter of color association with months, I have a relative who associates June and green, October and light crimson, December and blue.

I have strong color association with certain names; for example, —

Henry, Henrietta	= grass-green.
Sophia,	= dark green.
Louise,	= violet.
Charlotte,	= deep purple.
Alice,	= black and gold.
Francis,	= white and gold.
Emily,	= primrose-yellow.
Susan,	= pale blue.
Lucy,	= clear blue.
Anna,	= gold color.
Caroline,	= Naples-yellow.
Agnes,	= pearl gray.
Frances,	= pale fawn.
Lydia,	= a gay plaid, pink and green predominant.

Some of these, I suspect, are caused by the vowel in the name of the color and the proper name being the same. Lydia, perhaps, may wear the dress of the first owner of the name I ever saw. The others I cannot account for.

The months stand in a circle: December, January, and February grouped close together on the upper, or right hand; March and April curve around; May has a little more room; June, July, August, and September are wider apart; October and November correspond to March and April on the other side. The winter months are in the shade; the summer ones in a strong light.

F. M. SLACK.

THE LICK OBSERVATORY.

To German parents in Lebanon county, Penn., in the year 1796, was born a son, who received the name James Lick. As a boy, he learned the piano-maker's trade in Philadelphia, where, in youth and early manhood, he led a varied life, engaging in divers occupations, from the making and selling of furniture and pianos, to the managing of a theatre. When about thirty-five years old, he went to South America, where he resided chiefly at Buenos Aires, acquiring property to the extent of about forty-five thousand dollars, with which sum, in 1847, he emigrated to the site of the present San Francisco, and invested it in real estate. In a quarter of a century he found himself worth a fortune nearly one hundred times as great, which, by the execution of a deed of trust, he placed under the control of a board of trustees, of which Mr. Richard S. Floyd is now the president.

Mr. Lick died at the age of eighty years. His chief scientific bequest was the sum of seven hundred thousand dollars, for the erection of a great observatory at a mountain elevation. He was anxious to secure the highest elevation consistent with ready accessibility; and Lake Tahoe, nearly eight thousand feet above sea-level, was about the first site which came prominently to his notice. The proposed locality was visited, investigated, and rejected; and the site of Mount Saint Helena, an eminence much nearer San Francisco, was visited by Mr. Lick in person. Early in 1875 Mr. Thomas E. Fraser suggested Mount Hamilton, in the county of Santa Clara, as a desirable site; and, on his recommendation, Mr. Lick decided upon this eminence for the permanent location of the great observatory. Mount Hamilton is situate in the Pacific coast-range, about fifty miles south-east of San Francisco, and thirteen miles in a direct line from San José, the nearest city. A telephone-line, and an excellent mountain road, now connect the two.

Mount Hamilton has a treble-pointed summit, about forty-five hundred feet high; and no mountain within a radius of one hundred miles approaches this elevation. The two extreme peaks of the general summit are nearly a mile distant from each other, in a north-east, south-west direction. The southernmost peak is bare of all woody growth, and its lines converge to form an angle slightly acute. Although about a hundred and twenty-five feet lower than the northern summit, this peak was chosen by the trustees for the location of the observatory, on the advice of Professor Newcomb and Mr. Burnham; as it presented the greater advantage in point of accessibility, configuration, and a minimum of obstruction to the view south, east, and west. The first work was to cut down this apex; and about forty-five thousand tons of rocks were removed, leaving an irregularly oval plateau, about four hundred and fifty feet in length, and with an extreme breadth of about two hundred and twenty-five feet. The lands about the mountain, which are set aside for observatory purposes, comprise a government reservation of about fifteen hundred acres, to which the trustees have added a hundred and sixty acres by purchase.

The first astronomer who visited the site of the projected observatory was Mr. Sherburne

W. Burnham, who in the autumn of 1879, on the recommendation of Professor Holden and Professor Newcomb, was invited by the Lick trustees to make a systematic study of the suitableness of the atmospheric conditions for observational research. In October he was joined by Professor Newcomb, who remained for a few days upon the summit, to advise with regard to the proper location of the buildings and instruments. Mr. Burnham devoted two months' time to the measurement of close double stars. During the period, Aug. 17 to Oct. 16 inclusive, he found, —

First-class nights, 42; medium nights, 7; cloudy and foggy nights, 11.

The summer of 1881 marked great progress. The transit of Mercury in the latter part of that year was observed with the twelve-inch equatorial and the four-inch meridian transit instrument in their permanent quarters, Professor Holden and Mr. Burnham securing complete series of satisfactory contact-observations. During the period Oct. 20 to Nov. 9, Professor Holden found fourteen nights which were perfectly clear, with at least average conditions of vision; and one of them was exceptionally fine.[1]

In the summer of 1882 the results achieved on the mountain were even more important than during the year previous. The construc-

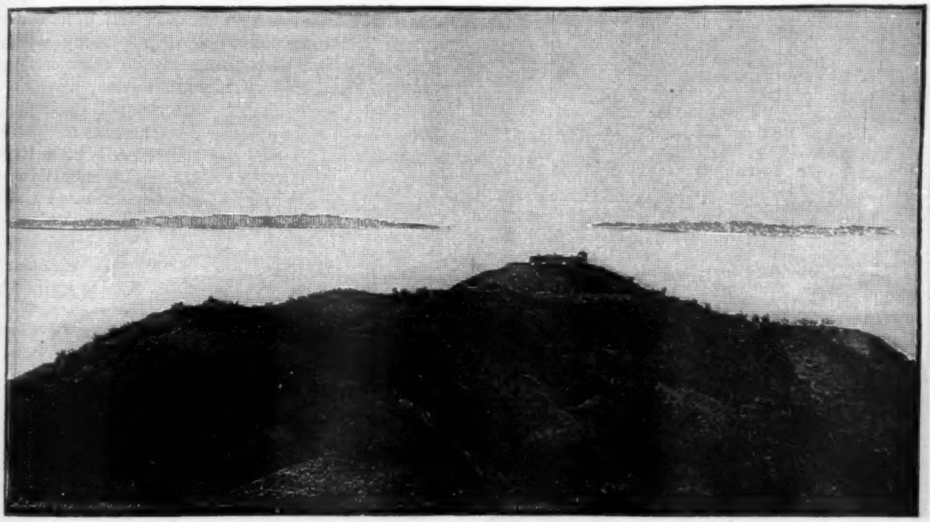


FIG. 1. — THE LICK OBSERVATORY. DISTANT VIEW FROM THE NORTH-EAST.

There was not in the whole time a single poor night when it was clear.

In the spring of 1880 Capt. Floyd spent several weeks in Washington, accompanied by Mr. Fraser, whom the trustees had appointed superintendent of construction of the observatory. There they were in daily consultation with Professor Newcomb, Professor Holden, and other astronomers, with regard to the plans of construction on the mountain, and the final instrumental equipment of the institution. Under their direction, the architect's plans for the main building were prepared at this time, and the work of construction was at once begun.

tion of the main building was rapidly carried forward, and the problem of water-supply for all future purposes was shown to be effectively solved. Springs of excellent water had been discovered about four hundred feet below the summit, and a reservoir large enough to hold eighty-five thousand gallons was built on the apex of the middle peak. A year later, the trustees took the additional precaution of providing a second reservoir of nearly seventy thousand gallons capacity, in which the rains are collected from the slate roofs on Observa-

[1] It is to be remembered that this was at the season of the year when the change from the summer to the rainy season was impending, and when the inequality of the temperature between the day and the night was something near the maximum.

tory peak, and stored for use at the houses and stables just below.

As Mr. Lick gave specific direction that the income from his endowment of the observatory should be made 'useful in promoting science,' his trustees wisely made thorough provision for observing the transit of Venus of 1882. A photoheliograph, for obtaining very accurate pictures of the sun, was added to the permanent equipment of the observatory, for the purpose of co-operating with the American transit-of-Venus commission. The president of the trustees invited Professor Todd to direct the observations on Mount Hamilton; and the excellence of the photographs obtained by the expedition is largely due to the wide experience of his photographer-in-chief, Mr. Lovell of Amherst. The work of the expedition has been fully described in *Science*, vol. i. p. 94; and the results obtained from these photographs have been incorporated with those secured under the immediate direction of the American commission. The period of residence of the party on the mountain (Nov. 21 to Dec. 21) included four nights totally cloudy, fourteen partly cloudy, six clear with good seeing, and seven clear with exceptionally fine conditions of vision. The solar eclipse of the 16th March, 1885, was also photographed at the observatory, under very favorable atmospheric conditions.

The illustration of the ground-plan of Observatory peak shows the exact location of all the buildings on the main plateau, and the arrangements of the rooms of the principal edifice. This is mostly a single story high; and like all the other buildings containing instruments, and the dwelling-house also, is fire-proof in construction. The interior finish of the main building is of superior quality throughout: the hall, about two hundred feet in length, with its floor and wainscot of marble, affords an excellent space for optical experiments. The diagram shows also the position at the extreme south end of the plateau, which will ultimately be occupied by the great telescope.

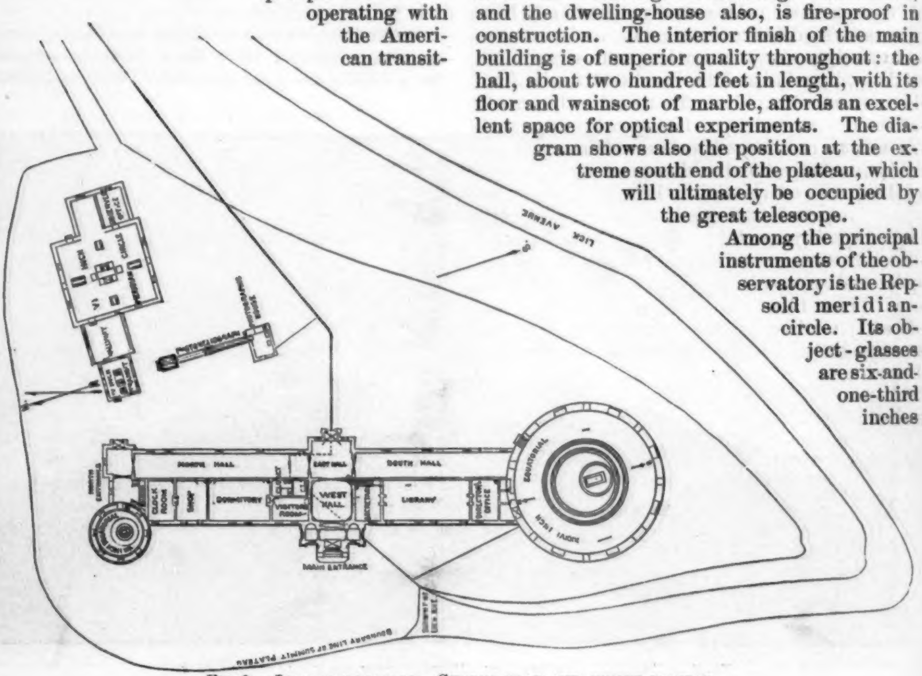


Fig. 2. — Lick observatory. Ground plan and summit plateau.

Among the principal instruments of the observatory is the Repsold meridian-circle. Its object-glasses are six-and-one-third inches in diameter, and were made by the Clarks. A house of unusual construction and proportions (at the left of the square tower in the centre of the 'near view,' fig. 3) has been built to shelter this instrument. The building is forty-three feet by forty-five, with an office-wing adjoining. It has double walls, the interior of wood, and the exterior of iron, with abundant space between for ready access to any part; and the arrangements for securing the same temperature within as without are perfect. The shutters closing the observing-slit are of a novel pattern, the device of Mr. Fraser. The interior of the observing-room is of California red-wood with a high finish. At the right, in the illustra-

tion of this interior (fig. 4), is shown a covered carriage on rails, which serves the purpose of additional protection to the instrument when not in use.

At the centre of the 'near view' (fig. 3), is shown the permanent dwelling for the director of the observatory and his colleagues. It is built of brick, just below the observatory plateau, and faces the north-east, with a frontage of fifty feet. It contains thirty rooms, and extends toward the mountain to a depth of sixty feet; and a short bridge from the third story of the house lands on the summit plateau, near the entrance to the meridian-circle room.

It will be seen that the observatory is already in a position, so far as the outfit of the establishment is concerned, to proceed at once with astronomical research. In addition to the instruments already mentioned, its equipment consists of a four-inch transit-instrument by Fauth; a four-inch comet-seeker by Clark; a measuring-engine by Stackpole, reading either rectangular or polar co-ordinates; five clocks by Dent, Frodsham, Hohwü, and Howard, and four chronometers by Negus; a system of electric connections involving all the observing and clock rooms; a six and one-third inch equatorial telescope; a two-inch Repsold vertical circle; a workshop, with a complete outfit of lathes and tools; and an astronomical library containing a choice selection of works of an exclusively technical character. This latter has already necessitated an expense of about five thousand dollars.

Popular interest in the observatory now centres chiefly in the remaining work of the trustees, which is threefold, — the making of the object-glass of the great telescope; the construction of the mounting or mechanical portions of this instrument; and the building of the enormous dome, which will be required to cover the telescope, and permit its most unconstrained use. Upon the construction of the dome and the mounting, the future usefulness of the great telescope will very largely depend.

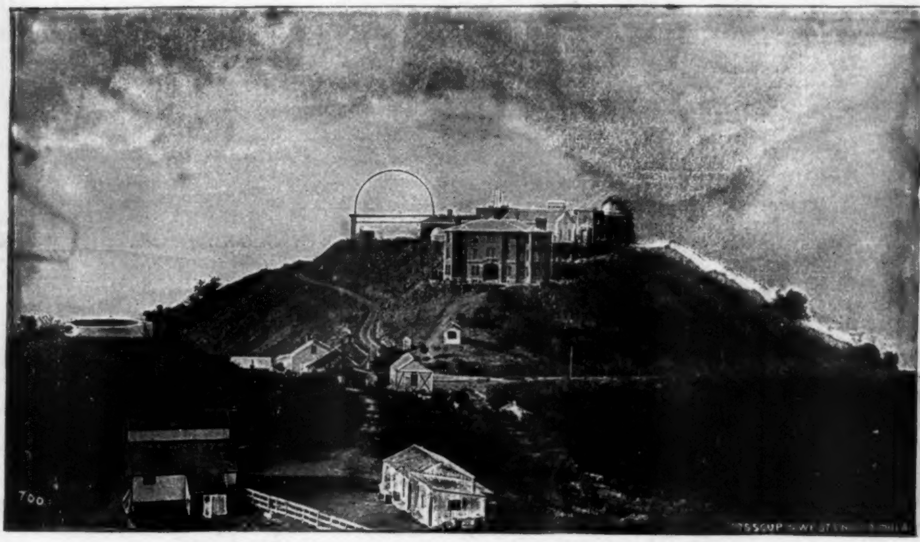


FIG. 3. — THE LICK OBSERVATORY. NEAR VIEW FROM THE NORTH-EAST.

The contract for the object-glass — amounting to about one-half the cost of the entire telescope — was placed with the Messrs. Clark nearly five years ago. Two years later they received from the glass-maker, Mr. Feil of Paris, a disk of flint-glass of the required perfection, and thirty-eight inches in diameter. This glass has already stood in their workshop at Cambridgeport nearly three years, and it is inexpedient for them to attempt to work it to the proper curvatures until its companion disk of crown-glass is secured: in fact, these curvatures cannot be definitely

decided upon until both disks have been carefully tested. The difficulties which the glass-maker has to encounter in obtaining so large a disk of crown-glass have been found to be much greater than with the flint, and fifteen or twenty moulds are said to have been ruined in the attempt to get them into the required disk-form. It is hoped that the glass-maker will succeed in accomplishing his task during the present season; and, in that event, the great telescope can readily be completed in 1887. Mr. Lick's trustees will then transfer the establishment to the University of California, and the observatory will subsequently be conducted under the control of the regents of that institution.

An inquiry often made, and a very natural and proper one, relates to the prospective capabilities of this enormous instrument, when mounted in so favorable an atmosphere, and directed to the moon. Every astronomer who has observed the heavenly bodies from Mount Hamilton knows that the extraordinary steadiness of the atmosphere enables him to regularly employ eye-pieces on his telescope which magnify two or three times as much as those he habitually uses for the same kinds of work at home. It is thus not unreasonable to expect that a few nights in the course of each observing-year may be found when the maximum magnifying-power — about thirty-five hundred diameters — may be advantageously employed on the great telescope. The theoretical distance of the moon would then become about sixty miles, but the corresponding ideal conditions of perfect vision can never be attained. Making due allowance for the unavoidable effects of the earth's atmosphere and other unfavorable conditions, the observer might expect to see the moon much the same as he would without the telescope if it were only a hundred miles away. If, at the same time, the moon happened to be at its least distance from the eye of the observer, — about 220,000 miles, — and if the object on the moon were suitably illumined by the sun's light, it is possible that details of its nature might be satisfactorily made out, even although they were no larger than some of the larger edifices on the earth.

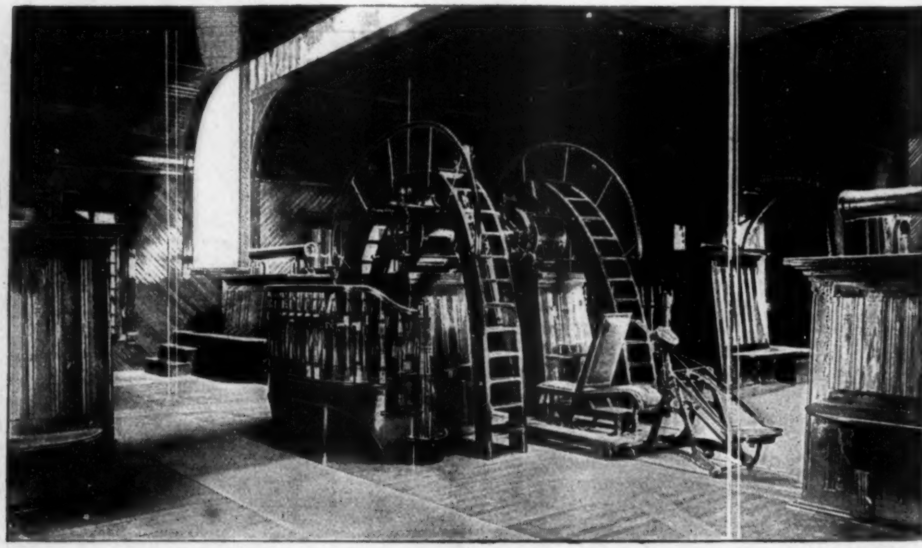


Fig. 4. — The Lick observatory. Interior of the meridian-circle house.

THE GROWTH OF THE FRENCH ACADEMY. 1635–1885.

It is interesting to trace the influences by which the French institute, *l'Institut de France*, as we know it in these days, has been developed from the French academy, *l'Académie*

française, of the days of Richelieu. The original society entered with enthusiasm upon a course marked out for it by the regulations of the founder. There was no precedent to be followed, no example to be imitated. The local academies in Italy may have suggested some of the statutes. The preparation of a standard dictionary, for example, may have been in imitation of the dictionary Della Crusca; but at that period, as now, the French liked to work in accordance with their own ideas of good method. Richelieu remained protector of the academy from 1635 until his death in 1642; and then, not Cardinal Mazarin, nor the prince of Condé, both of whom were thought of, but Séguier, already a member of the academy, and the chancellor of France, succeeded to the honor. When he died, the academy, which had grown up to the dignity projected for it by its illustrious founder, invited the king himself to become its patron; and the grand monarch did not hesitate to add this new jewel to his crown. He gratified the academicians by many tokens of royal favor, — for example, invitations to court entertainments, and a present of forty *fauteuils*, — and they flattered him with frequent acts of literary obsequiousness. To Louis XIV. as protector succeeded Louis XV. and Louis XVI.; and, when the monarchy fell in the revolution, the academy fell with it as if it were a royal council. When afterwards revived, it was in a humiliated form.

Two other academies were instituted in France soon after the French academy, — the Academy of inscriptions and belles-lettres, and the Academy of sciences; the first-named in 1663, and the other in 1666. There was also an Academy of painting founded in 1648; but it did not take rank with the others, and was subsequently reorganized as the Academy of fine arts. In the provinces also, — at Arles, Nismes, Soissons, Metz, and elsewhere, — local academies, based upon the model of the capital, grew up, and were (in many cases, if not in all) affiliated with one of the academies in Paris.

The Academy of inscriptions and belles-lettres was at first only a section or committee of the French academy, — four of the members having been selected by the king to decide upon the proper forms to be observed in the legends which should be cut on medals, and in the inscriptions which should be put upon the monuments designed to perpetuate his honor. He fitly called it 'his little academy.'

Fig. 5. — The Lick observatory. View to the north-west, "above the clouds."

Such atrocious pomposity can hardly be conceived of in our day as characterized the egoism of Louis XIV. Nevertheless, better things than he projected came from the association which he evoked for the purpose of devising inscriptions, mottoes, and medals, and for making suggestions in respect to royal *fêtes*, tapestries, and operas. The simple organization of 1663 was revised in 1701; and then, for a long period, associated and co-operative learning, of a very high order, distinguished the Academy of inscriptions. The first volume of its memoirs appeared in 1717; and before the revolution forty-six quarto volumes had been printed, embodying important historical and classical memoirs.

The Academy of sciences was founded in 1666, and reorganized in 1699. It has a history of its own so distinct from that of the French academy, and so illustrious, that we shall not attempt to give it in any subordinate paragraph.

The tragic days of the revolution swept good things as well as bad into the vortex. In August, 1793, the convention decreed that all academies and literary societies authorized (*patentées*) by the nation be suppressed. When the reign of terror was over, a reaction naturally came. The leaders of public opinion were ready to recognize the value of organized efforts for the promotion of knowledge; and the convention, two years after its abolition of the academies, established an *Institut national* for promoting discoveries, and for advancing the arts and sciences. This was in October, 1795. The new foundation was to be composed of a hundred and forty-four members resident in Paris, and a like number in other parts of France, together with twenty-four foreign associates. Three 'classes' were established, — the *first*, of mathematical and physical science, with ten sections, each of which had six Parisian and six departmental members; the *second*, of moral and political sciences, with six sections of the same number of members; and the *third*, of literature and the fine arts, divided into eight sections, each of six Parisian and six departmental members. The directory was to nominate forty-eight members from Paris; they were to select ninety-six more; and this company of one hundred and forty-four were to choose an equal number of colleagues from the departments. Subsequent legislation matured the regulations of the institute; but in 1803, Napoleon, then first consul, gave them a thorough overhauling. For three classes, he substituted four. That of moral and political sciences, to which he seemed to owe a grudge, was abolished. The old French academy, which had almost disappeared in the 'section of grammar,' now reappeared as the second class of the new institute, and the academy of sciences became the first class. History and ancient literature, representing the old academy of inscriptions, gave the name to the third class, and the fourth was that of the fine arts. Here substantially were the four academies of the monarchy united in one bond. The second class, representing the *Académie française*, was restricted to forty chairs; and twelve of the occupants might be chosen from the other classes of the institute.

The reaction went still farther, on the restoration of royalty. In 1816 the French academy, which had been suppressed, then barely recognized as a grammatical section, afterwards allowed the second place among the classes of the institute, was now reinstated in its true position, and recalled by its original and honored name. The institute, reads the new decree, shall consist of four academies, named as follows, and in the order of their foundation, — the French academy, the academy royal of inscriptions and belles-lettres, the academy royal of sciences, and the academy royal of fine arts. Members of any academy are eligible to the three others. The French academy resumes its former statutes. It was not until sixteen years later, in 1832, that the academy of moral and political sciences was reinstated under the ministry of Guizot. The second empire modified in some details the regulations of the Institut; and the new republic in 1872 removed these imperial modifications, and restored the former statutes, under which the institute of France is now organized with its five academies.

We have thus traced in outline the growth of the French academy during two centuries and a half. A private club employs such excellent methods of associated criticism, that it is recognized by the state, and made an important public agency for the promotion of letters. Kindred associations are formed upon its model. It grows so steadily in importance, that at length three kings successively assume its protection. When the crown falls in the days of anarchy, the academy and its sisters are suppressed. As order is restored to the state, the institute of France rises from the ashes, hiding in its organization the faint remembrance of the academy. Presently the old organization is distinctly recognized, but without its name and without the precedence which is its birthright. The next step is to re-establish it, with its earliest designation, as

first in the group of five academies, by which, under the name of the *Institut*, the people of France provide for the preservation and improvement of their language, for the promotion of history, for the advancement of science, for the encouragement of art, and for the establishment of just ideas in morals and politics.

THE SOCIETY FOR THE PROMOTION OF AGRICULTURAL SCIENCE.

THE sixth annual meeting of this society at Ann Arbor, Aug. 25, may fairly be said to have been the best of the number, whether as regards the attendance of members and others, the number and character of the papers read, or the general interest and profit of the discussions.

The meeting was opened on Tuesday morning by a paper from Mr. J. J. Thomas of New York, upon 'The influence of locality upon varieties of fruit,' in which the author opposed the opinion which has been advanced by eminent pomologists, that varieties of fruit raised on our own soil and in our own localities are, on that account, better suited to this country. As regards pears, fully half our varieties are of foreign origin; and very many of these are among our most esteemed varieties, notably the Bartlett, and can hardly be equalled by the same number of native varieties. In the case of the apple, while many good varieties are of foreign origin, this fruit has been so extensively and successfully cultivated in America that our best varieties have come to be those of native origin. At the same time, most of the esteemed western and southern varieties are of eastern origin. The apple is very susceptible to influences of locality during the growth and ripening of the fruit; and this fact, rather than any differences due to origin, accounts for the preference shown for different varieties in different regions.

In the discussion following the paper, attention was called by Dr. E. L. Sturtevant to what appears to be the fact, that well-ripened specimens of any fruit are of the highest flavor in the most northern localities, while the size and appearance usually improve as one goes southward; and he suggested as a possible explanation the influence of actinism. During the growing season, plants receive more hours of sunlight in northern than in southern localities; and it is possible that this has something to do with their higher flavor. The subject is an important one for investigation. He also described a simple and inexpensive apparatus for automatically recording the number of hours of sunlight daily, without reference to intensity. This apparatus is now in use at the N. Y. experiment station; and the U. S. signal service is considering its introduction at a number of stations, in the hope that a record of the hours of sunlight may at least show whether it is desirable to attack the much more difficult problem of measuring its actinic intensity.

Prof. W. J. Beal confirmed Dr. Sturtevant's statement as to the flavor of fruit from northern and southern localities as regards Michigan fruits. Mr. Crozier instanced an experiment in which flowers from the same seed grown in Paris and in Upsala were much brighter colored in the more northern locality. Prof. I. P. Roberts called attention to the fact, that the soil has also much to do with the flavor of apples, stating that about Ithaca, N.Y., the best apples were grown on a clay soil and in elevated localities.

Following Mr. Thomas's paper were two by Dr. E. L. Sturtevant of New York, upon the 'dandelion' and 'lettuce.' These papers were in support of the hypothesis that the form-species of cultivated plants are not originated by culture, but are really selections from wild types. Thus in Vilmorin, Andrieux et Cie's seed-catalogue, three distinct varieties of dandelion are figured. Upon the grounds of the N. Y. experiment station, there are to be found growing wild, under conditions which seemingly preclude the possibility of their being escapes from cultivation, dandelions corresponding very closely to these three varieties. Moreover, two of these three varieties are figured respectively by Anton Pinaeus in 1561, and by Dodonaeus in 1616.

If it be granted, upon this evidence, that the cultivated varieties of dandelion are simply selections from wild types, "it may be legitimately questioned whether other of our cultivated form-species in other plants are not likewise of natural origin. A careful investigation into the history of the origin of our cultivated varieties, fully justifies the statement that I have as yet secured no data which justify the belief that form-species in culture are other than of natural origin; and I have secured much evidence in favor of the view that form-species are introductions from natural variations."

The paper upon lettuce is in further confirmation of this hypothesis. It should be said, however, that the author expressly recognizes the fact that much further study is necessary before so radical a belief can receive countenance.

In the ensuing discussion, Professor Bailey called attention to the fact that variable wild plants are those most likely to be selected for improvement, as to a certain extent sustaining the hypothesis advanced in the papers.

The afternoon session was opened by a paper upon 'The demands made by agriculture upon the science of botany,' by Prof. C. E. Bessey of Nebraska. The paper was devoted to the subject of the teaching of botany in colleges; and the writer made an earnest plea for the more extensive and thorough study of this science, classifying the demands made upon it by agriculture under three heads: First, a nomenclature and classification of the plants of the farm, cultivated as well as wild. Second, a better knowledge of the physiology of plants, including such subjects as growth and nutrition, fertilization, heredity, and the physiology of cultivation and improvement. Third, a better knowledge of the pathology of plants, particularly of that ill-defined state known as 'lowered vitality.'

Several speakers following Professor Bessey, commended the sentiments of his paper, and deprecated the undue attention given to systematic botany in many cases, where the chief end of the study seems to be to enable the student to find out the technical name of the plant.

A paper by Prof. T. J. Burrill of Illinois, upon 'An experiment in silk-culture,' came next upon the programme. The experiment was but very partially successful as regards the production of silk, the larger part of the worms dying of a contagious disease at about the time when they should have formed cocoons. The investigation of this disease formed the main subject of the paper. The disease was identified by the author, and by Professor Forbes, with the *flacherie* of Pasteur, and was plainly not the disease which he describes under the name *pébrine*. It also appears to be identical with a disease which has lately proved very fatal to the larvae of the cabbage butterfly. The writer was not aware that any one had previously positively determined the existence of true *flacherie*, or of *pébrine* in America; but, if the conclusions of his paper were correct, the former, at least, has, in all probability, long existed here unrecognized.

In remarking upon the above papers, Prof. C. V. Riley claimed that both these diseases of the silkworm had been recognized by entomologists in this country, though they had not been able to give the disease that careful microscopical and bacteriological study which Professors Burrill and Forbes had done. He also stated his belief that the germs of *flacherie* are omnipresent, and that the disease may be induced at any time by unsanitary conditions.

A paper followed by Major Henry E. Alvord of New York, upon 'Telemetric aid to meteorological records,' describing briefly an apparatus made by the Telethermometer company of New-York city, by which a continuous record of temperature can be obtained at any reasonable distance from the place of observation, and with very little trouble. The results of about six months' comparison of one of these instruments, with thirteen daily readings of a standard mercurial thermometer, showed a tolerably close agreement between the two. The telethermometer was slightly tardy in its changes, and usually failed markedly to reach the minimum daily temperature, and frequently fell a little short of the maximum. The author considered it — though by no means perfect — to be the best aid yet found for recording atmospheric temperatures in connection with agricultural studies.

The next paper was by Prof. H. P. Armsby of Wisconsin, upon 'The creaming of milk by the Cooley system.' It was chiefly statistical, giving the results of some two hundred and fifty experiments in creaming the milk of single cans by this system; and showing that in eleven hours 90-99 per cent of the fat of the milk was recovered in the cream, as against 75-80 per cent in some recently reported German experiments in which the temperature of the water surrounding the cans of milk was much higher. The experiments furnished also some hints as to further investigations upon the influence of small variations of temperature upon the process, but no definite conclusions.

A paper by Prof. G. C. Caldwell of New York, upon 'The lactobutyrometer,' consisted chiefly of a review of the tests of this instrument on record; but contained also some experiments as to the cause of the failure of the process in certain cases to extract even approximately all the fat from milk, particularly that from highly-fed cows. The author concludes that his experiments are at least not inconsistent with the belief that either an albuminous envelope, or some sort of an accumulation of albuminoid matter about the fat globules, gives rise to the difficulty.

A brief report by Prof. W. J. Beal, upon the progress of experiments on the vitality of buried seeds, and a short account by Prof. C. V. Riley of a new remedy for locusts, which has been successfully used in California, and the reading by title of a paper by Prof. E. W. Hilgard "On some redeeming traits of 'alkali' soils," closed the reading of papers.

At the business meeting, the following officers were elected for the ensuing year: President, Henry E. Alvord; secretary and treasurer, B. D. Halsted; executive committee, Henry E. Alvord, B. D. Halsted, and E. M. Shelton.

THE DEVELOPMENT OF THE EYE.

IN a recent paper before the Philadelphia academy, Dr. Benjamin Sharp has endeavored to trace the development of the highly complex vertebrate eye from the simplest deposit of pigment in an epithelial cell. The simplest organ of vision is found in the Lamellibranchiata; but these are not the primitive organs of the group, the ancestral eyes being present in a few forms for a short time during the free larval stage. The most primitive adult eyes are found in the common oyster, in which the free edge of the mantle is lined with a number of epithelial cells (fig. 1) having a nucleus (n), a deposit of pigment (p), a transparent cuticula (c), with an undoubted power of vision. The next step of advance is illustrated in the common Venus, in which the eyes are confined to the most exposed part of the body, the so-called siphon. So far there has been no protection to the visual organs other than that afforded by the shell; but in Venus the fact that there are pigment cells at the base as well as on the extremities of the tentacles indicates a change soon o take place. This change is well shown in the razor-shell Solen (fig. 2), where all the eyes are arranged about the base of the tentacles, and, furthermore, are sunk into deep grooves. The organ is also much more perfect.

FIG. 1. — Visual cells of Ostrea virginica. c, cuticle; p, pigment; n, nucleus.

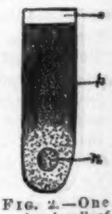


FIG. 2. — One visual cell of Solen vagina. c, cuticle; p, pigment; n, nucleus.

In the Gastropoda, from which the lamellibranchs have probably degenerated, the visual organs take

their morphological position at the oral end of the body; and, with only one or two exceptions, there is but a single pair of eyes. In Patella, the row of eyes last seen in Solen has become a simple sphere of pigmented cells; and in Haliotis we have also an open sphere, but, instead of the refractive cuticula in front of each cell, there is one combined mass forming a lens, which is purely a secretion, not cellular as in vertebrates. Fissurella goes practically as far as any gastropod, having a closed eye containing a lens, and a transparent epidermal covering acting as a cornea. Both Fissurella and Haliotis have a distinct nerve specialized for sight, which connects the eye with the superior cephalic ganglion.

In an early stage of the vertebrate embryo, the anterior medullary groove divides into three segments,— the fore, mid, and hind brain. The fore-brain sends outwards and laterally a swelling, which increases in size, and passes on to the epidermis; and here an invagination takes place to meet this outward brain-growth. This invagination finally closes, and soon becomes cut off, forming a hollow vesicle, the cavity of which is finally obliterated, and, becoming transparent, forms the lens of the adult eye. In the mean time the growth from the brain has arched over and above this vesicle; and then, folding over laterally, it encloses the lens (fig. 3), which fills up the anterior opening of the cavity of this 'secondary optic vesicle.' After the closure is completed by the union of *a* and *b*, there is a double-walled vesicle, the interior wall giving rise to the many layered retina, while the external wall forms the pigment layer of the choroidea.

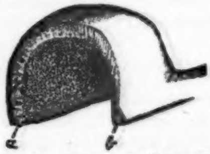


FIG. 3.—Diagram to illustrate the method by which the secondary optic vesicle encloses the lens which should fill up the open end. Eye of vertebrate.

The evolution of this eye seems simple; for, as soon as it became of importance to its possessor, a corresponding stimulation took place in the brain, where sight is without doubt seated. An increase of development began all along the tract, from the lens to the brain; and, as this increased, that part of the brain nearest the eye enlarged, and proceeded by steps outward in a manner similar to the process now taking place in the development of the eyes of Vertebrata. We then have a stage in which a part of the brain closes over the superior part of the eye, being separated by a layer of fibres which is the much shortened and flattened primitive optic nervè. The pedicle connecting this advanced part of the brain, which may be looked upon as a ganglion, will now be called the 'secondary optic nerve,'—the optic nerve of the eyes of the adult Vertebrata. Dr. Sharp thus holds, 1°, that the lens of the vertebrate eye is homologous with a primitive invaginated eye, such as we find to-day in the gasteropods; 2°, that the layer of optic fibres of the retina is homologous with the primitive optic nerve.

In vertebrates as well as invertebrates we frequently find blind animals, the near relatives of which have well-developed organs of sight. In these cases the accessory organs are first to disappear, the lens first; and in the lowest forms of degeneration, Branchiostoma notably, nothing remains but a slight deposit of pigment on the anterior end of the neural canal. This deposit in Branchiostoma, and a similar deposit in some larval Ascidia, have led Lankester to regard the primitive type of Vertebrata as a transparent animal with eyes sessile in the brain; but Dr. Sharp's investigations have led him to the opinion that forms so degenerate as these should not be taken as a standard on which to base our conclusions in regard to the origin of the vertebrates.

CIVILIZATION AND EYESIGHT.

THE discussion following Lord Rayleigh's article upon 'Civilization and eyesight' (*Nature*, No. 798, p. 340) has resulted in a clear exposition of this interesting subject. Rayleigh is of the opinion that the supposed superiority of the savage eye is merely a question of attention, and practice in the interpretation of minute indications; and that it is comparable with the acuteness of the blind in drawing conclusions from slender acoustical premises. It is doubtful whether the blind can hear sounds wholly inaudible to others; and, likewise, it seems impossible for the savage eye, with practically the same aperture as the civilized eye, to resolve objects, beyond a certain point, calculable by the laws of optics from the wave-length of light.

J. Rand Capron (*Nature*, No. 799, p. 359) suggests that, in considering the question of aperture, the fact that this, though probably following a general rule applicable alike to savages and civilized beings, varies in individual cases, should be taken into account. He mentions an assistant who had a singularly 'sharp' eye, and could pick out with ease companions to double stars, small satellites, etc., which others saw with difficulty. The pupils of his eyes were always larger than those of most other persons; and he had the peculiar power of being able to read fine print with ease when the gas was turned half on, and it was his habitual custom to read in this way. He suggests that there must be something more than a mere 'question of attention and interpretation of minute details,' when a savage can resolve two distant dots into distinctly appreciable personages, as regards sex and garments.

R. Brudenell Carter urges (*Nature*, No. 800, p. 386) that there is no necessity for a larger aperture to explain acuteness of vision. The savage might have greater sensitiveness to variations of light, greater sensitiveness to color, and acuteness of vision over a larger retinal area. All these advantages might be conferred by better formation or higher development of the retina; and such higher development might at once be promoted by exercise, and handed down by descent. He believes that the conditions of town-life are unfavorable to the evolution, and favorable to the degradation, of the eye; and, further, that a mod-

erate amount of attention might greatly modify these conditions, and might do for the eyes what is done by athletic games and exercises for the muscles.

A still different explanation of the phenomenon is given by G. B. Buckton (*Nature*, No. 801, p. 407). The same amount of light entering the eyes of different individuals produces widely different effects, according to health or age. A student becoming accustomed to see objects from a short distance, will permanently accommodate himself to a short focus, and hence become short-sighted. Such modifications can be conceived of as being hereditary, and long-sight might be brought about in a race by the opposite use of the eye.

Apropos to this discussion, it may be well to notice briefly a discussion upon near-sightedness, which was started by Lord Rayleigh's article. The investigation of the question of the increasing prevalence of short-sight, which has recently been carried on in Germany, has led to legislative restrictions in the schools. The numerous statistics from the German schools have shown that the proportion of short-sighted boys continually increases from form to form; and from this fact it has been argued that the continued use of the eyes for the perception of near objects, is the essential, if not the only, factor in the production of short-sight. This view is again supported by the statistics, which allot the largest proportion of short-sighted individuals to those branches of industry, or those pursuits, which constantly call for near vision. In this connection, Mr. George A. Berry (*Nature*, No. 800, p. 387) suggests that two points have been forgotten in arriving at such a conclusion. In the first place, there is an undoubted tendency to grow short-sighted with age alone, up to the period of cessation of growth. This has been shown to be due to the elongation of the antero-posterior axis of the eye, and is no more a disease than is the attainment of more than an average height by certain individuals. It is merely a type; and, as such, is governed by the laws of heredity. A small proportion of cases are, however, due to disease; and these are as frequent among the illiterate as the educated, and are not hereditary. In many cases, people drift into literary and similar pursuits because they are near-sighted, and not well adapted for other occupations. Further, as a man's circle of acquaintance is, for the most part, amongst individuals having similar interests in life, intermarriage in myoptic families must frequently occur, and would tend to perpetuate, and perhaps increase, the defect. In savages, on the other hand, where the great principle of survival of the fittest is not frustrated to the same extent as among civilized races, every thing would be against the perpetuation of a myoptic type.

CHEYNE'S OBSERVATIONS ON THE CHOLERA MICROBE.

IN connection with the work of Van Ermengem upon the cholera bacillus (*Science*, No. 133), that of Cheyne, recently published (*British med. journ.*, April 25–May 23, 1885), deserves attention. This gives the results of his investigations at Paris during the epidemic of cholera, and afterwards at his own laboratory. In eight cases investigated, he found the curved bacilli in larger or smaller numbers: in a ninth case, supposed to be cholera, but turning out not to be, no curved bacilli were found. He failed to demonstrate these bacilli in the walls of the intestines in almost all cases; and, when he succeeded in finding them at all, they were very indistinct. He very justly observes, however, that Koch may succeed in such a demonstration where others fail; for Koch's technique is unquestionably superior to that of any other worker in this field.

Having sent his slides and cultures to Koch, and having the latter's assurance that they were pure, and made up of the curved bacillus of Asiatic cholera, Cheyne made various experiments with them in culture-media of different kinds and at different temperatures, the results of all of which were in conformity with what was already known. In particular, he found no difficulty in repeating Koch's observation, that drying rapidly destroys the vitality of these organisms: 'in three hours they are completely dead.'

His conclusions are, that the comma bacillus was present, and generally in large numbers, in all the cases of cholera which were examined; and that he has never met with the cholera bacillus except in cholera, and that the other curved bacilli described (Finkler and Prior's, Lewis's, and Dencke's or Flügge's), differ from it in important particulars.

Inoculation experiments were performed on seventeen guinea-pigs, with successful results in only two. Two other animals died, but were not examined, because destroyed. (We would suggest greater care of his inoculated animals, for these misfortunes seem to be but a repetition of those that happened in this observer's work on tuberculosis; see *Practitioner*, April, 1883.)

The last part of Mr. Cheyne's article is devoted to an able refutation of Klein's arguments against the specific nature of the comma bacillus. He shows the hasty work of this observer, which has led him to conclusions so entirely at variance with those of Koch and his supporters. He (Cheyne) thus summarizes his opinion of the work of the English cholera commission: "The two errors which, in my opinion, lie at the root of the work of the English cholera commission are, first, that, acting on the idea that Koch diagnosed the cholera bacilli by the microscope alone, they proceeded to investigate the matter by microscopic examination; and, secondly, that, seeing the stress which Dr. Koch laid on the cultivation appearances, they concluded that he meant to say that the organism was pathogenic, because it grows in a particular manner: and, therefore, they naturally proceeded to inquire whether the appearance of the cultivations, as compared with cultivations of other bacteria, could warrant this conclusion; and, of course, they found that it could not."

MOSQUITOES VS. TROUT.

MR. C. H. MURRAY of Denver writes to Professor Baird the following letter, which we are permitted to print in advance of its publication by the U. S. fish commission: —

In the middle or latter part of June, — I think it was, — in 1882, I was prospecting on the head-waters of the Tumiche Creek in the Gunnison valley, Col. About nine o'clock in the morning, I sat down in the shade of some willows that skirted a clear but shallow place in the creek. In a quiet part of the water, where their movements were readily discernible, were some fresh-hatched brook or mountain trout; and circling about over the water was a small swarm of mosquitoes. The trout were very young, still having the pellucid sack puffing out from the region of the gills, with the rest of their body almost transparent when they would swim into a portion of the water that was lighted up by direct sunshine. Every few minutes these baby trout — for what purpose I do not know, unless to get the benefit of more air — would come to the surface of the water, so that the top of their head was level with the surface of the water. When this was the case, a mosquito would alight, and immediately transfix the trout by inserting his proboscis, or bill, into the brain of the fish, which seemed incapable of escaping. The mosquito would hold his victim steady until he had extracted all the life juices; and when this was accomplished, and he flew away, the dead trout would turn over on his back, and float down the stream. I was so interested in this before unheard of destruction of fish, that I watched the depredations of these mosquitoes for more than half an hour; and in that time over twenty trout were sucked dry, and their lifeless shells sent floating away with the current. It was the only occasion that I was ever witness to the fact, and I have been unable by inquiry to ascertain if others have observed a similar destruction of fish. I am sure the fish were trout, as the locality was quite near snow line, and the water very cold, and no other fish were in the stream at that altitude. From this observation, I am satisfied that great numbers of trout, and perhaps infant fish of other varieties in clear waters, must come to their death in this way; and, if the fact has not been heretofore recorded, it is important to those interested in pisciculture.

LAST YEAR'S MEETING OF THE AMERICAN ASSOCIATION.

THE proceedings of the American association for the advancement of science for 1884 were ready for publication only just prior to the date appointed for the meeting at Ann Arbor. They extend through 736 pages, to which there is an index covering sixteen pages. As usual, a large part of the papers are represented only by titles and abstracts, some others have already been printed; so that the volume is chiefly to be valued for reference, rather than for the freshness of its contents. It appears to have been carefully edited by the secretary, and to contain in exact and convenient forms all the general information respecting officers, membership, committees, and official acts to which we have been so long accustomed. Of course we cannot allude specifically to the long array of scientific communications here presented; but we will venture to call the attention of the general reader to the various addresses which he will find in the volume, and which, taken collectively, afford a very good insight into the aspect of scientific studies in this country and at this time.

A re-examination of the opening address of Prof. C. A. Young of Princeton, on the 'Pending problems in astronomy,' has confirmed our first impressions of its value. Indeed, we do not hesitate to call it a model discourse for such an occasion. The president of the association selected a theme which he was fully qualified to discuss, — one which enabled him to look forward as well as backward, one which was of equal interest to the astronomer and to the students of other sciences. The style in which he wrote was bright, and fitted to engage the attention of any well-educated person, while it remained free from all that was extraneous or sensational. No better introduction can be found to the present condition of astronomical science.

The addresses of the vice-presidents are also given. That of Professor Eddy is a complaint and an appeal, with respect to the neglect of mathematics by our countrymen, and recalls a like complaint which was made by Professor Newton when he was sectional vice-president a few years ago, and a well-known article by Professor Newcomb in the *North-American review* for 1874. It is difficult to account for the intellectual abstinence of Americans, to which these writers refer, from domains so inexhaustible as those of modern mathematics, except by remembering the eagerness of everybody in this land — scholars and teachers, as well as investors and merchants — for immediate results, — for the concrete rather than the abstract. Professor John Trowbridge entitles his address 'What is electricity?' — a question which he knows, as well as anybody, is easier asked than answered. Nevertheless, around this inquiry he has grouped a large number of important and suggestive statements, which were particularly appropriate at a time when the national electrical congress was about to meet in the city of Franklin. In

this address, and in that of Professor Eddy, the personal experience of the speaker is so introduced as to give a peculiar value to what is said. Professor Langley of Ann Arbor discusses 'Chemical affinity,' "the bud our science put forth in its alchemical stage," but a bud which of late appears to have withered. By an elaborate review he endeavors to show that "it is the word only which has become obsolete; the idea behind it is still active and of great importance." Professor Thurston, now of Cornell, takes a much broader theme, the 'Mission of science,' and naturally falls into a more rhetorical paper. In almost optimistic language he points out the value of applied science, and especially of mechanics as an aid to government in the promotion of social welfare. "The mission of science," he claims, "is to be fulfilled mainly through the application of mechanics." It has made as yet "but the veriest beginning," — but in the end the improvement of mankind and the development of the human soul are within the range of its potentials. The geological address, by Prof. N. H. Winchell, is in marked contrast to that of Professor Thurston. It is a paper of purely professional interest. He discusses, as a geologist, the crystalline rocks of the northwest, and especially of Minnesota. It has been usual to refer these rocks either to the Huronian or the Laurentian: now this nomenclature is acknowledged to be imperfect. The difficulties and incongruities of the situation are clearly set forth. Professor Cope likewise addresses an audience of specialists, — though the biological specialists in these days are a very comprehensive company. His subject is 'Catagenesis;' and he announces his definition of life to be "energy directed by consciousness, or by a mechanism which has originated under the direction of consciousness," — and he concludes that "all forms of energy have originated in the process of running down, or specialization from the primitive energy." Professor Wormley's address on the applications of the microscope in chemical and micrometric observations is only given in abstract. Professor Morse discusses man in the tertiaries, — not any particular man, we may assure our sceptical readers, but the-possibly-to-be-discovered man. "The progenitors of quaternary man, under different genera possibly, are to be sought for in the tertiaries." In the section devoted to economics, Gen. John Eaton very briefly considers scientific methods and scientific knowledge in common affairs.

EXPERIMENTS IN MEMORY.

WHEN we read how one mediaeval saint stood erect in his cell for a week without sleep or food, merely chewing a plantain-leaf out of humility, so as not to be too perfect; how another remained all night up to his neck in a pond that was freezing over; and how others still performed for the glory of God feats no less tasking to their energies, we are inclined to think, that, with the gods of yore, the men, too, have departed, and that the earth is handed over to a race whose will has become as feeble as its faith. But we ought not to yield to these instigations by which the evil one tempts us to disparage our own generation. The gods have somewhat changed their shape, 'tis true, and the men their minds; but both are still alive and vigorous as ever for an eye that can look under superficial disguises. The human energy no longer freezes itself in fish-ponds, and starves itself in cells; but near the north pole, in central Africa, on alpine 'couloirs,' and especially in what are nowadays called 'psycho-physical laboratories,' it may be found as invincible as ever, and ready for every fresh demand. To most people a north-pole expedition would be an easy task, compared with those ineffably tedious measurements of simple mental processes of which Ernst Heinrich Weber set the fashion some forty years ago, and the necessity of extending which in every possible direction becomes more and more apparent to students of the mind. Think of making forty thousand estimates of which is the heavier of two weights, or seventy thousand answers as to whether your skin is touched at two points or at one, and then tabulating and mathematically discussing your results! Insight is to be gained at no less price than this. The new sort of study of the mind bears the same relation to the older psychology that the microscopic anatomy of the body does to the anatomy of its visible form, and the one will undoubtedly be as fruitful and as indispensable as the other.

Dr. Ebbinghaus makes an original addition to heroic psychological literature in the little work whose title we have given. For more than two years he has apparently spent a considerable time each day in committing to memory sets of meaningless syllables, and trying to trace numerically the laws according to which they were retained or forgotten. Most

Ueber das gedächtniss. Untersuchungen zur experimentellen psychologie. Von HERM. EBBINGHAUS. Leipzig, *Duncker u. Humblot*, 1885. 10+169 p. 8°.

of his results, we are sorry to say, add nothing to our gross experience of the matter. Here, as in the case of the saints, heroism seems to be its own reward. But the incidental results are usually the most pregnant in this department; and two of those which Dr. Ebbinghaus has reached seem to us to amply justify his pains. The first is, that, in *forgetting* such things as these lists of syllables, the loss goes on very much more rapidly at first than later on. He measured the loss by the number of seconds required to *relearn* the list after it had been once learned. Roughly speaking, if it took a thousand seconds to learn the list, and five hundred to relearn it, the loss between the two learnings would have been one-half. Measured in this way, full half of the forgetting seems to occur within the first half-hour, whilst only four-fifths is forgotten at the end of a month. The nature of this result might have been anticipated, but hardly its numerical proportions.

The other important result relates to the question whether ideas are recalled only by those that previously came immediately before them, or whether an idea can possibly recall another idea, with which it was never in *immediate* contact, without passing through the intermediate mental links. The question is of theoretic importance with regard to the way in which the process of 'association of ideas' must be conceived; and Dr. Ebbinghaus's attempt is as successful as it is original, in bringing two views, which seem at first sight inaccessible to proof, to a direct practical test, and giving the victory to one of them. His experiments conclusively show that an idea is not only 'associated' directly with the one that follows it, and with the rest *through that*, but that it is *directly* associated with *all* that are near it, though in unequal degrees. He first measured the time needed to impress on the memory certain lists of syllables, and then the time needed to impress lists of the same syllables with gaps between them. Thus, representing the syllables by numbers, if the first list was 1, 2, 3, 4 . . . 13, 14, 15, 16, the second would be 1, 3, 5 . . . 15, 2, 4, 6 . . . 16, and so forth, with many variations.

Now, if 1 and 3 in the first list were learned in that order merely by 1 calling up 2, and by 2 calling up 3, leaving out the 2 ought to leave 1 and 3 with no tie in the mind; and the second list ought to take as much time in the learning as if the first list had never been heard of. If, on the other hand, 1 has a *direct* influence on 3 as well as on 2, that influence should be exerted even when 2 is dropped out; and a person familiar with the first list ought to learn the second one more rapidly than otherwise he could. This latter case is what actually occurs; and Dr. Ebbinghaus has found that syllables originally separated by as many as seven intermediaries, still reveal, by the increased rapidity with which they are learned in order, the strength of the tie that the original learning established between them, over the heads, so to speak, of all the rest. It may be that this particular series of experiments is the entering wedge of a new method of incalculable reach in such questions. The future alone can show. Meanwhile, when we add to Dr. Ebbinghaus's 'heroism' in the pursuit of true averages, his high critical acumen, his modest tone, and his polished style, it will be seen that we have a new-comer in psychology, from whom the best may be expected.

W. J.

NOTES AND NEWS.

THE articles of scientific interest in the general English and American magazines for August are neither numerous nor interesting. Two topics seem to have monopolized the popular scientific mind during the midsummer months, — dogs and cholera.

There are two articles on dogs worth mentioning. One is a paper in *Bailey's monthly magazine* on 'The descent of the foxhound,' in which the writer attempts to show that the foxhound was produced about the beginning of the eighteenth century by a process of careful selection, and not, as some have supposed, by crossing a swift-footed hound with some dog of keener scent. In the *Century* appears the second part of Mr. John E. Thayer's beautifully illustrated account of 'Typical dogs.' A clear and concise account is given of the appearance, traits, etc., of the water spaniels, collies, and fox-terriers.

Six gentlemen of the medical profession have taken occasion to express themselves on the cholera question.

In the *Nineteenth century*, Dr. Charles Connor, in an article entitled 'Anti-cholera inoculation,' attempts to show statistically that Dr. Ferran's experiments have been more successful than those of Jenner were; and that by the anti-cholera vaccination process the danger of dying from cholera is made about six times less than it would be under normal circumstances. Dr. J. Burdon Sanderson, in the *Contemporary review*, gives his views on the causes and prevention of cholera. This writer gives a brief sketch of the history of cholera, shows to his own satisfaction that Koch's comma bacillus has nothing to do with cholera, and then goes on to say the ordinary things about good drainage, careful diet, etc. But it is in the *North-American review* that the greatest number of articles, and the least amount of information, is to be obtained on the subject of Asiatic

cholera. Four gentlemen, Dr. John B. Hamilton, Dr. H. Rausch, Dr. C. Peters, and Dr. H. C. Wood, have each tried to answer the question: Can cholera be averted? In these papers the germ origin of cholera is admitted, but no particular bacillus is fixed on as the cause of the disease. The best methods of disinfection, etc., are spoken of, isolation of the sick recommended, and the necessity of cleanliness is urged; but no facts or theories are set forward of which the public are not already in possession.

Besides the notes on dogs and cholera, there have also appeared one or two other articles which might be called semi-scientific. In the *Gentlemen's magazine*, there is an interesting and well written paper on the wild cattle of North America, by C. F. Gordon Cummings, describing the appearance, distribution, and extinction of the American bison; and the *Cornhill magazine* has a very popular article on the 'Birth of mountains.'

— The Alabama state signal-service found it impracticable to use the same signals employed by the Ohio service, for three reasons : 1°. Because the railroad refused to allow red to be used on their lines. 2°. On account of the considerable cost of the Ohio set of signals (eighteen to twenty-four dollars); and 3°. From the fact, that, in a calm, it was found impossible to distinguish between the star, the crescent, and the sun. After correspondence with the U. S. chief signal-officer, five flags were determined on according to the accompanying illustrations. Their

cost when made of bunting is something less than that of the Ohio flags: and when made of cotton cloth, the outlay is only a few cents each; while the solid colors allow the predictions to be read at a considerable distance. The railroad authorities have entered cordially into the system, and telegraph the predictions free of charge; except in the case of two or three companies not owning their telegraph lines, who expose the signals on their trains. In most cases they are hung on poles. The black triangular flag when placed above indicates rising temperature; when placed below indicates falling temperature; if absent, indicates stationary temperature.

— On account of the lack of funds necessary to maintain its activity, the astronomical observatory of Beloit college, Wisconsin (Prof. J. Tatlock, jun., director), has been closed.

— The annual meeting of the American forestry congress will be held at Boston, beginning Sept. 22, under the auspices of the local societies of horticulture and agriculture. Mr. W. C. Strong of the Horticultural society is chairman of the local committee, and Mr. Daniel Needham of Boston is the chairman of the sub-committee of accommodation; and to the latter, requests for special arrangements for board should be sent. The hotel headquarters will be at the Adams House. Three sessions daily will be held at Horticultural Hall. Monday, Sept. 22, will be given up to addresses, reports, and general business; Wednesday, to the reading of papers and discussions; and Thursday, to excursions, — among others, to the Arnold Arboretum. Over twenty papers have already been promised, and many others are expected. The discussions will be conducted as far as possible under the following heads: 1°. Importance of forests in climatic and hydraulic respects, and in regard to other industries. 2°. Duties and rights of the state to protect her forest resources. 3°. Forest fires: causes; laws and methods for their restriction. 5°. Education and research in forestry matters: arbor days; schools; lectures; exhibits; experiment stations; press; associations. 5°. Practical forestry: prospects, methods, profits, etc.

— If any indication of the mathematical activity of different nations is afforded by the number of those who have published contributions bearing upon one of the most notable of recently developed branches of mathematical investigation, England is at this moment occupying a very subordinate position in the advancement of pure mathematics. A bibliography of the modern theory of linear differential equations, which appeared in the last number of the *American journal of mathematics* (vol. vii., No. 4), gives in all sixty-eight writers, of whom only two are English, while twenty-seven are French, seventeen German, nine Italian, and the rest are divided among eight different nationalities, there being one American. This disproportion between the English and the French or Germans, is greatly increased, when the number and importance of the memoirs contributed by the various writers are taken into account.

— We learn from *L'astronomie* that the crown disk for the great thirty-six-inch refractor of the Lick observatory, referred to in an earlier column, has recently been delivered to Alvan Clark & Sons, by Feil, the celebrated Paris manufacturer of optical glass. The elder Feil has reorganized the establishment, associating with himself his son and M. Mantois. The two disks for the thirty-inch Nice refractor have been placed in the hands of the Henry brothers, who take charge of the optical work; and it is hoped that the glass will be finished in October.

— The American philological association will hold its next meeting at Cornell University, Ithaca, N.Y., on July 13, 1886. The presiding officer will be Professor Tracy Peck of Yale college.

— *Nature* states that it has been decided to withhold from publication the report of Drs. Klein and Gibbes upon Dr. Koch's discoveries in relation to the germ theory of cholera, until the conclusions of a committee appointed by the secretary of state for India with reference to that report are also ready.

— *Ausland*, a German weekly published at Stuttgart, is now printing an interesting serial upon the influence of the glacial period upon the formation of the physical surface of Lower Germany, by Th. Overbeck, in which Torell's hypothesis is subjected to criticism. This weekly is now in its fifty-eighth year.